



## **NASA STTR 2016 Phase I Solicitation**

### **T15 Aeronautics**

A strong national program of research and development (R&D) for aeronautics technology forms the foundation of the U.S. aeronautics and aviation enterprise. Aeronautics R&D is critical for national security and homeland defense, an efficient national air transportation system, and the economic well-being and quality of life of our citizens. The National Aeronautics Research and Development Plan (Plan) lays out high-priority national aeronautics R&D challenges, goals, and supporting objectives to guide the conduct of U.S. The Plan includes an important new goal regarding the integration of unmanned aircraft systems into the National Airspace System. In addition, this R&D Plan:

- Supports the coordinated efforts of the Federal departments and agencies in the pursuit of stable and long-term foundational research.
- Ensures U.S. technological leadership in aeronautics for national security and homeland defense capabilities.
- Advances aeronautics research to improve aviation safety, air transportation, and reduce the environmental impacts of aviation.
- Promotes the advancement of fuel efficiency and energy independence in the aviation sector; and Spurs the development of innovative technologies that enable new products and services.

Most of the R&D goals and objectives will require stable and long-term foundational research across a breadth of aeronautics disciplines to provide the underlying basis for new technological advances and breakthroughs. Such foundational research is often cross-cutting, resulting in technology advances that have applications across several Principles. Moreover, new ideas and technologies that are generated by foundational research will help inform future updates to the National Aeronautics Research and Development Plan.

## **Subtopics**

### **T15.01 Power Systems for Hybrid Electric Propulsion**

**Lead Center:** GRC

Proposals are sought which support the technology development of power systems for aircraft hybrid electric propulsion. Hybrid electric propulsion systems, involving distributed propulsion provided by an electric power system, requires the integration of propulsion, electric power, and aerodynamics.

Distributed propulsion systems using electric motor driven fans, with power electronics used for voltage and frequency control, and having peak load equal to the total power generation provides unique challenges associated with the power system control and protection methods. The nonlinear, constant power propulsor loads also

---

complicate the stable operation of the power control, and the limited capacity of the generators complicates the protection system and recovery control following faulted operation. Proposals addressing the power management and stability issues inherent in these kinds of power systems, and the power control methods that can be exploited to enable the power system for distributed hybrid electric propulsion are needed.

The inclusion of electric power for distributed propulsion, with much faster dynamics, also requires innovative methods for simulation of the integrated system. Advanced hybrid (algebraic and dynamic) power system simulations using load flows methods in conjunction with dynamics as needed to allow for an integrated simulation capability are also of interest.

New approaches for advanced power electronic switching devices that go beyond wide band gap semiconductors and utilize graphene or carbon nanotubes, and added manufacturing methods that can be utilized to manufacture an integrated electro-magnetic and electrical structure for electric machines are also of interest.

## **T15.02 Aeronautical Communications, Navigation, Surveillance and Information (CNSI) Systems for UAS**

**Lead Center: GRC**

Under the Aeronautics Research Mission Directorate, work will be performed to conduct fundamental, cutting-edge research into new aircraft technologies as well as the integration of new operations concepts and technologies into the Next Generation Air Transportation System (NextGen). Communications, Navigation, Surveillance and Information (CNSI) technology development supports the goals of these research programs in such areas as increasing airspace system capacity and efficiency, improving aviation system safety, and advancing the integration of unmanned aircraft into the national airspace system (NAS). Aviation nationally and globally is being developed upon a new paradigm of digital information transaction, supporting coordination and collaboration between airspace users and service providers based on collection and sharing of information on a much greater scale than ever before. NASA has contributed to this technological advance through the testing of control communications for unmanned aircraft, development of aircraft antennas for high frequency satellite communications, testing and demonstration of secure, high-rate wireless communications for airports, ground and flight testing of air-ground communications channels, and simulation, modeling and analysis of digital air traffic communications. Future research and technology development supports such initiatives as autonomous NAS operations and vehicles, mobile components of system-wide information management, beyond-line-of-sight control communications for unmanned aircraft, and national airspace system-wide performance assessments.

This solicitation seeks innovative approaches to Unmanned Aircraft Systems (UAS) communications for civil aviation in the current and future NAS, including for small UAS (< 55 lbs).

Desired focus areas include:

- CNSI operations technologies supporting unmanned vehicle integration into the national and global airspace systems, including advanced civil aviation air traffic control systems (including UAV traffic management), air traffic management, and airspace operations.
- CNSI system concepts, architectures and networks.
- Aeronautical CNSI components and subsystems for operation in civil aviation bands. These designs must account for all applicable aircraft certification and airworthiness requirements.
- Beyond line of sight communications technologies for UAS.